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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/035,972	11/09/2001	David Yogev	6327 USA/PDC	3792

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APPLIED MATERIALS, INC.
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EXAMINER

JOLLEY, KIRSTEN

ART UNIT

PAPER NUMBER

1762

DATE MAILED: 09/30/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/035,972	YOGEV ET AL.	
	Examiner	Art Unit	
	Kirsten C Jolley	1762	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-55 is/are pending in the application.
- 4a) Of the above claim(s) 46-55 is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-45 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on ____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
 If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 a) ☐ All b) ☐ Some * c) ☐ None of:
 1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. ____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
 * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
 a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s). ____. |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) ____. | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Election/Restriction

1. Restriction to one of the following inventions is required under 35 U.S.C. 121:
 - I. Claims 1-45, drawn to a method for removing particles from a surface, classified in class 427, subclass 212.
 - II. Claims 46-55, drawn to an apparatus for removal of particles from a surface, classified in class 134, subclass 198.

The inventions are distinct, each from the other because of the following reasons:

2. Inventions I and II are related as process and apparatus for its practice. The inventions are distinct if it can be shown that either: (1) the process as claimed can be practiced by another materially different apparatus or by hand, or (2) the apparatus as claimed can be used to practice another and materially different process. (MPEP § 806.05(e)). In this case the apparatus can be used to practice another materially different process, for example the apparatus can be used to apply and remove a developer solution from a substrate surface. (It is noted that, in developing apparatus, lasers can be used in wafer alignment mechanisms.)

3. Because these inventions are distinct for the reasons given above and have acquired a separate status in the art as shown by their different classification, restriction for examination purposes as indicated is proper.

4. During a telephone conversation with Robert Mulcahy on July 31, 2003 a provisional election was made with traverse to prosecute the invention of Group I, claims 1-45. Affirmation of this election must be made by applicant in replying to this Office action. Claims 46-5 are

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withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

5. Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

Claim Rejections - 35 USC § 102

6. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

7. Claims 1-3, 6, 8-9, 14-15, and 18 are rejected under 35 U.S.C. 102(e) as being anticipated by de Larios et al. (US 6,488,040).

With respect to claims 1 and 18, De Larios et al. discloses a method for cleaning particles from a semiconductor wafer surface (col. 1, lines 23-34) comprising the steps of applying a fluid (either gas or liquid) to the surface to coat the particles with the fluid and applying a suction force to remove the particles from the surface. The particles left on a surface after chemical mechanical polishing would inherently include particles having a dimension of less than approximately one micron. The invention of de Larios et al. inherently removes the particles of

submicron size, including less than 0.2 microns, because de Larios et al. teaches that its invention leaves a clean surface, and because the process steps of de Larios et al. are materially similar to Applicant's, which claims the removal of submicron particles. Any differences in properties between the claimed invention and that of de Larios et al. must have been caused by process variables not claimed.

As to claim 2, de Larios et al. teaches that the cleaning fluid may be DI water (col. 7, lines 47-49).

As to claim 3, de Larios et al. teaches using a mixture of one or more gases as a drying fluid in its invention. It is noted that one of the gases would meet the limitation of a carrier for the other.

As to claim 6, the cleaning fluid is deposited onto the surface via inlets 140 and then is suctioned off the surface via outlets 142, as shown in Figure 8. The cleaning fluid would inherently "wait" and be contacted with the surface for a predetermined period of time, even if only a fraction of a second, prior to being suctioned off the surface. It is noted that "predetermined period of time" reads on any length of time, including a fraction of a second.

As to claims 8 and 9, as can be seen in Figure 8, the fluid is applied through a channel held approximately perpendicular to the surface, and the suction is applied through an annular channel surrounding the channel through which the fluid is applied.

As to claim 15, de Larios et al. teaches that the aperture sizes of outlet channels are 5-5000 microns, or 0.005-5 mm, which meets the claimed range limitation (col. 6, lines 48-54).

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8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

9. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

10. Claims 7, 11-13, 16-17, 19-21, 24-27, 29-40, and 42 are rejected under 35 U.S.C. 103(a) as being unpatentable over de Larios et al. (US 6,488,040).

With respect to claim 7, de Larios et al. does not disclose the length of time that the cleaning fluid contacts the surface between being applied and being suctioned out via suction outlets. It appears that the length of time would be a fraction of a second, depending upon the application force and the suction force in the inlet and outlet channels, the type of cleaning fluid used and its viscosity, wetting properties of the surface, and the width of the inlet and outlet channels. It is noted that Applicant's range is likewise a fraction of a second, 0.01. to 2 seconds. It is well settled that determination of optimum values of cause effective variables such as this process parameter is within the skill of one practicing in the art. *In re Boesch*, 205 USPQ 215 (CCPA 1980).

As to claim 11, de Larios et al. discloses holding the suction channels substantially perpendicular to the substrate surface. The claims read on holding the channels at a tilt angle of 1-40 degrees from the perpendicular. The Examiner notes that, during use in industry, it is likely for the apparatus to fall slightly off calibration and thus be at a slight angle. A tilt angle of 1 degree would necessarily read on a cleaning apparatus that is not 100% perpendicular, and is not a patentable variation of the apparatus and method of de Larios et al.

As to claim 13, de Larios et al. is silent with regard to the length of time that the suction force is applied. The length of time of suction is cause-effective depending upon the degree of suction used, the amount of cleaning fluid that is applied to the surface, the type and viscosity of the particular cleaning fluid, surface properties, and the length and width of the suction channels. It is well settled that determination of optimum values of cause effective variables such as these process parameters is within the skill of one practicing in the art. *In re Boesch*, 205 USPQ 215 (CCPA 1980).

As to claim 16, de Larios et al. teaches that the aperture sizes of outlet channels are 5-5000 microns, or 0.005-5 mm, which meets the claimed range limitation (col. 6, lines 48-54). Overlapping ranges are *prima facie* evidence of obviousness. It would have been obvious to one having ordinary skill in the art to have selected the portion of de Larios et al.'s aperture size range that corresponds to the claimed range. *In re Malagari*, 184 USPQ 549 (CCPA 1974).

With respect to claim 17, de Larios et al. states "The distance of the proximity head 102a to the water 108 during fluid removal operations may also depend on wafer surface properties. It should be appreciated that the proximity head may move to any distance from the surface of the

wafer 108 as long as fluid may be removed from the wafer surface by capillary action" (col. 6, lines 1-7).

As to claims 12, 19, 37, and 42, de Larios et al. does not disclose the horizontal flow velocity of the cleaning fluid at the surface of the substrate. It is the Examiner's position that the horizontal flow velocity would be dependent upon a number of factors including the degree of suction, the pressure of the fluid as it is applied to the substrate, the surface wetting properties, and the viscosity of the cleaning fluid, among others. One skilled in the art would have desired a high velocity in order to increase the efficiency of the process, however would have also allowed enough cleaning fluid contact time on the surface such that the particles and residue on the surface are removed with the cleaning fluid. It is well settled that determination of optimum values of cause effective variables such as these process parameters is within the skill of one practicing in the art. *In re Boesch*, 205 USPQ 215 (CCPA 1980).

Claims 20-21, 24-27, and 29-36 are rejected for the reasons discussed above with respect to claims 2-3, 6-9, and 11-18.

As to claim 38, de Larios et al. teaches using DI water as the cleaning fluid in col. 7, lines 47-49. Claims 39-40 are rejected for the reasons discussed above with respect to claims 8-9.

11. Claims 3 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over de Larios et al. (US 6,488,040) as applied to claims 1 and 19 above, and further in view of Kawasaki (US 6,059,893).

Claims 3 and 21 are alternately rejected over the prior art of de Larios et al. in view of Kawasaki.

De Larios et al. lacks a teaching of using a carrier gas to convey a liquid cleaning fluid (such as DI water) to the surface. Kawasaki is cited for its teaching in the Background section of a conventional process for cleaning particles from a semiconductor surface comprising applying or blowing an inert gas and pure water to the surface (col. 1, lines 17-23). It is the Examiner's position that it would have been obvious for one having ordinary skill in the art to have used a mixture of DI water and inert gas as the cleaning fluid in the method of de Larios et al., upon seeing the Background of Kawasaki in combination with de Larios et al., because Kawasaki teaches that a cleaning fluid of pure water and inert gas successfully removes particles from a semiconductor surface and because de Larios et al. is not limited to the cleaning fluids which may be used in its invention or the use of liquids or gases. The test of obviousness is not express suggestion of the claimed invention in any or all references but rather what the references taken collectively would suggest to those of ordinary skill in the art presumed to be familiar with them. *In re Rosselet*, 347 F.2d 847, 146 USPQ 183 (CCPA 1965); *In re Hedges*, 783 F.2d 1038.

12. Claims 4-5, 10, 22-23, 28, and 41 are rejected under 35 U.S.C. 103(a) as being unpatentable over de Larios et al. (US 6,488,040) as applied to claims 1-3, 6-9, 11-21, 24-27, 29-40, and 42 above, and further in view of Toshima (US 6,146,469).

De Larios et al. lacks a teaching of heating the cleaning fluid that is applied to the substrate surface to remove particles therefrom. Toshima is cited for its teaching of achieving improved cleaning of particles of less than 0.1 microns using ultra-pure dry steam as the cleaning solution (see col. 4, lines 25-34 and col. 3, lines 26-34). Toshima teaches heating the deionized, ultra-pure water, in combination with the process chamber and fluid transfer tubes to a

temperature between 25-150 degrees C (col. 6, lines 40-66), in combination with evacuating the process chamber in order to form ultra-pure dry steam. It would have been obvious for one having ordinary skill in the art to have used ultra-pure dry steam as the cleaning fluid in the process of de Larios et al. in order to achieve the improved results of using both kinetic and thermal energy to provide rapid, efficient, and economical removal of smaller particles and residue from a semiconductor surface. Such use of ultra-pure dry steam would necessarily comprise the step of heating the fluid delivery and suction channels of de Larios et al.'s apparatus. Overlapping ranges are *prima facie* evidence of obviousness. It would have been obvious to one having ordinary skill in the art to have selected the portion of Toshima's temperature range that corresponds to the claimed range. *In re Malagari*, 184 USPQ 549 (CCPA 1974).

13. Claims 43-45 are rejected under 35 U.S.C. 103(a) as being unpatentable over de Larios et al. as applied to claims 1-3, 6-9, 11-21, 24-27, 29-40, and 42 above, and further in view of Engelsberg (US 5,024,968) or WO 00/38935 A1.

As to claim 43, De Larios et al. lacks a disclosure of using a laser such that absorption of the laser beam at the surface releases the particle from the surface. Engelsberg and WO '935 are cited for their teachings of using a laser to remove surface contaminants from the surface of a substrate. It would have been obvious for one having ordinary skill in the art to have used a laser removal step, as taught by Engelsberg or WO '935, in addition to the cleaning fluid and suction removal method of de Larios et al. in order to ensure that all particles, even those that are difficult to remove using cleaning fluid, are removed from the semiconductor substrate surface.

Claims 44 and 45 are rejected for reasons discussed in the paragraphs above with respect to claims 2 and 19.

Conclusion

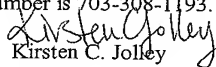
14. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Toshima (US 6,146,469), Kawasaki (US 6,059,893), Zahorik et al. (US 6,103,636), Grutzediek et al. (US 6,021,785), Blackwood (US 4,132,567), Snodgrass et al. (US 6,092,937), and JP 2-146733 A are each cited for teaching applying a cleaning fluid to a substrate to remove particulates or residues therefrom, and using suction to withdraw the cleaning fluid and particulates from the surface. Maekawa et al. (US 5,868,866) is cited for its use of high pressure water to clean semiconductor surfaces.

15. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kirsten C Jolley whose telephone number is 703-306-5461. The examiner can normally be reached on Monday to Thursday and every other Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Shrive Beck can be reached on 703-308-2333. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-1193.


Kirsten C. Jolley
Patent Examiner
Technology Center 1700